

Requested Patent: WO9807368A1  
Title: DATA GLOVE FOR SENSING MOVEMENTS ;  
Abstracted Patent: WO9807368 ;  
Publication Date: 1998-02-26 ;  
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Application Number: WO1997SK00007 19970820 ;  
Priority Number(s): SK19960001078 19960821 ;  
IPC Classification: A61B5/11; G06F3/00 ;  
Equivalents: AU4038397, SK107896 ;

**ABSTRACT:**

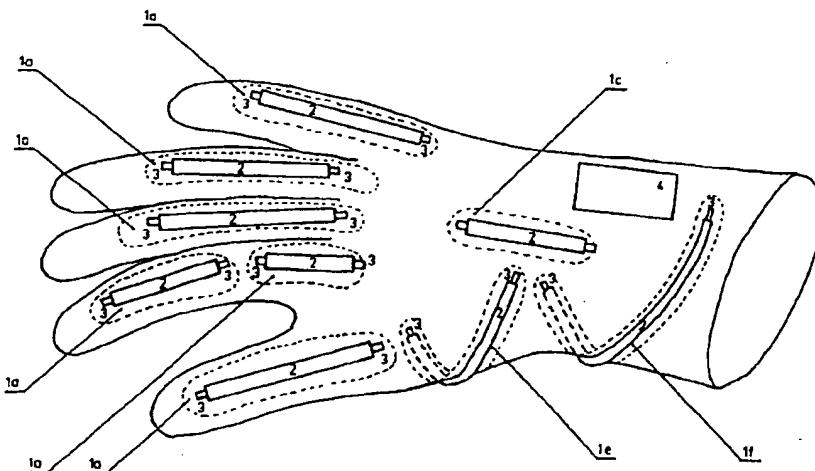
Movement of the hand are sensed by the change of electrical conductance of gum strips (2) glued or thermally applied to various portions (1a-1f) of a data glove. The gum strips (2) are placed at portions adjacent to the upper parts (1a) of the fingers, at places between individual fingers (1b), at the wrist (1c), at the outer palm (1d), at the lower thumb (1e) and at the lower part of the wrist (1f). The output leads (3) of the gum strips (2) are connected to an A/D converter (4).



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>A61B 5/11, G06F 3/00</b>		A1	(11) International Publication Number: <b>WO 98/07368</b> (43) International Publication Date: 26 February 1998 (26.02.98)
(21) International Application Number: PCT/SK97/00007		(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).	(22) International Filing Date: 20 August 1997 (20.08.97)
(30) Priority Data: PV 1078-96 21 August 1996 (21.08.96) SK			
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(74) Agent: KOVAČIK, Štefan; Jasovská 13/15, 851 07 Bratislava (SK).		Published	<i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: DATA GLOVE FOR SENSING MOVEMENTS



## (57) Abstract

Movement of the hand are sensed by the change of electrical conductance of gum strips (2) glued or thermally applied to various portions (1a-1f) of a data glove. The gum strips (2) are placed at portions adjacent to the upper parts (1a) of the fingers, at places between individual fingers (1b), at the wrist (1c), at the outer palm (1d), at the lower thumb (1e) and at the lower part of the wrist (1f). The output leads (3) of the gum strips (2) are connected to an A/D converter (4).

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## DATA GLOVE FOR SENSING MOVEMENTS

### The field of Technics

Invention is concerned of new method of scanning of movement and new construction of data glove. The invention belongs to the field of sensing Technics.

### Present condition of Technics

In sensing Technics the first and the oldest method of sensing the movement of individual parts of human body e.g. hand was the one with using potenciometers. Potenciometer was fixed to e.g. knuckle part of finger. Stretching or bending of finger caused the motion of control level of potenciometer, which caused the change of resistance of potenciometer. So this method was based on alternation of resistance of potenciometer. Nowadays the mentioned method is not used anymore, because it is cumbersome. Moreover used potenciometers are demanding on preciseness.

Another sensing method is scanning with the help of optical fibres, which is widely used in present time. The method is based on sensing of light current during bending of two, against isolated optical fibres. Both optical fibres are aiming opposite to each other. The more finger is stretched, the more light penetrates from one fibre to another and vice versa. Of course, the fibres have to be placed in the dark and the ends of the fibres have to be as straight as possible. It is very practical solution, because the environment influences the sensing of movement in minimum. Disadvantage of this sensing method is pretentious electronic equipment and preciseness of mechanical construction.

Another known sensing method with using infra-red beams requires a placement of special balls e.g. on hand, which reflect infra-red beams to all sides. Infra-red beams reflected from hand are sensed by infra-red cameras from at least three angles. There was a sensing method with four cameras used in practice. This method is expensive, because except of cameras there is a need for suitable intelligent software and efficient computer for determining the position in space. The advantage of this sensing method is the possibility to sense absolute position of whole body in space. Previously

described sensing methods can not determine the absolute position of sensed object in space.

The most widely used sensing method is probably the one with the help of ultrasound. It enables to determine absolute position in space. Ultrasound sensing method in combination with two scanners is used for ascertaining of winding up. Sensing with the help of two small gyroscopes is used more often. They sense slight turning either according to gravitational field of the earth or to magnetic field of the earth.

### The essence of invention

Data glove is able to remove the above mentioned insufficiencies according to claims described in invention. Its essence is based on placing the scanners of movement made of conductive gum in local places. Local places are considered to be bends on fingers and wrist.

Moreover the essence of invention is qualitatively extended by exactly defined shape of scanners of movement made of conductive gum, which is strip.

Further essence of the invention is based on characteristic method of fixing the scanners of movement made of conductive gum to glove. It is advantageous if scanners of movement from conductive gum are at least partly thermically fixed to the glove e.g. ironed or glued by suitable glue.

Another point in the invention is the fact that scanners of movement from conductive gum are equiped with outlets flowing in A/D converter. In another excution data glove can be equiped with ultrasound sender for detecting absolute position in space.

Finally quantitative base of the invention is the fact, that local places of data glove are precisely specified places of upper parts of finger, places between individual fingers, place on the wrist, place on lower thumb part, place on outer palm part and finally place of lower part of wrist revolvery aiming to lower part of forearm.

Advantage of this sensing of movement and of the glove designed for it is that scanning takes place 83 times per second thanks to A/D converter. Next, data glove secures wider range of useable positions. Then glove is suitable for different shapes and sizes of hands. Precedence of scanners of movement from conductive gum is also, that it is possible to produce from them different shapes of scanners of movement. The shape of strip is

advantageous. Fixing of scanners of movement to glove is very simple. Two outlets of scanners of movement from conductive gum are sufficient, opposite to three conductors with optical fibre. All these advantages are finally showing on the price of the product.

### Survey of pictures on sketches

Invention is clearly demonstrated on sketches. Picture, number 1 shows the placement of local places (1a, 1c, 1e, and 1f) on the object of data glove. Picture, number 2 shows the placement of other local places (1b, 1d) on the object of data glove. Picture number 3 and number 4 shows the fixing of scanners (2) of movement on data glove in local places (1a to 1f).

### Realisation of invention and its examples

By bending the finger, wrist or twisting other part of hand inserted in data glove the scanner 2 of movement made of electrically conductive gum is stretched, which causes the change of electric conduct of conductive gum. Changes of electric conduct are transferred through signal way to A/D converter 4 and further information processing follows. Data glove solution is the following one. There are scanners 2 of movement made of conductive gum placed in local places 1a to 1f of data glove. Local places of data glove are places 1a of upper part of fingers, place 1c on the wrist, place 1e in lower thumb part and place 1f of lower part of wrist rotationally aiming to lower part of forearm, as it is demonstrated on picture number 1. Other local places of data glove are places 1b between individual fingers and place 1d on outer palm part, as it is shown on picture number 2. It doesn't matter on the material which data glove is made of. But there is one required condition. It has to be nonconductive material (gum, leather). The shape of strip for scanner 2 of movement is advantageous. Scanner 2 from conductive gum is at least partly glued or thermally other way attached by suitable glue, or simply ironed to the local places from 1a to 1f. Every scanner 2 from conductive gum contains two outlets 3, which are in one variant of realisation output by cable besides data glove. In another variant of realisation outlets 3 from individual scanners 2 of movement are connected to 12 bit A/D converter 4, as it is demonstrated on picture number 3. If there

is a requirement on data glove to ascertain absolute position in space, then it is additionally equipped with ultrasound sender 5 as it is demonstrated on picture number 4.

#### Industrial utilization

According to the invention the sensing method of movement can be used not only for scanning the movement of hand, but also for scanning the movement of leg or other parts of body. With the scanners of movement it is possible to construct not only data glove, but also data leg or data suit.

## PATENT CLAIMS

1. Method of scanning of movement is characteristic way that movement is sensed by the change of electrical conductance of conductive gum by its stretching.
2. Data glove is characteristic way that there are scanners (2) of movement from conductive gum placed on local places (1a to 1f) of data glove.
3. Data glove according to claim 2 is characteristic way that scanners (2) of movement made of conductive gum are in shape of strip.
4. Data glove according to claims 2 and 3 is characteristic way that there are scanners (2) of movement from conductive gum at least partly glued or thermicly other way attatched to local places (1a to 1f) on data glove.
5. Data glove according to clames 2 to 4 is characteristic way that scanners (2) of movement from conductive gum are equiped with outlets (3).
6. Data glove according to clames 2 to 4 is characteristic way that outlets (3) of scanners of movement from cunductive gum lead into A/D converter (4).
7. Data glove according to clames 2 to 6 is characteristic way that it is additionally equiped with ultrasound sender (5) for ascertaing of absolute position in space.
8. Data glove according to clames 2 to 4 is characteristic way that local places (1a) are places of upper part of fingers, local places (1b) are places between individual fingers, local place (1c) is the place on wrist, local place (1d) is the place on outer palm part, local place (1e) is the place in lower thumb part and local place (1f) is the place from lower part of wrist rotarily aiming to lower part of forearm.

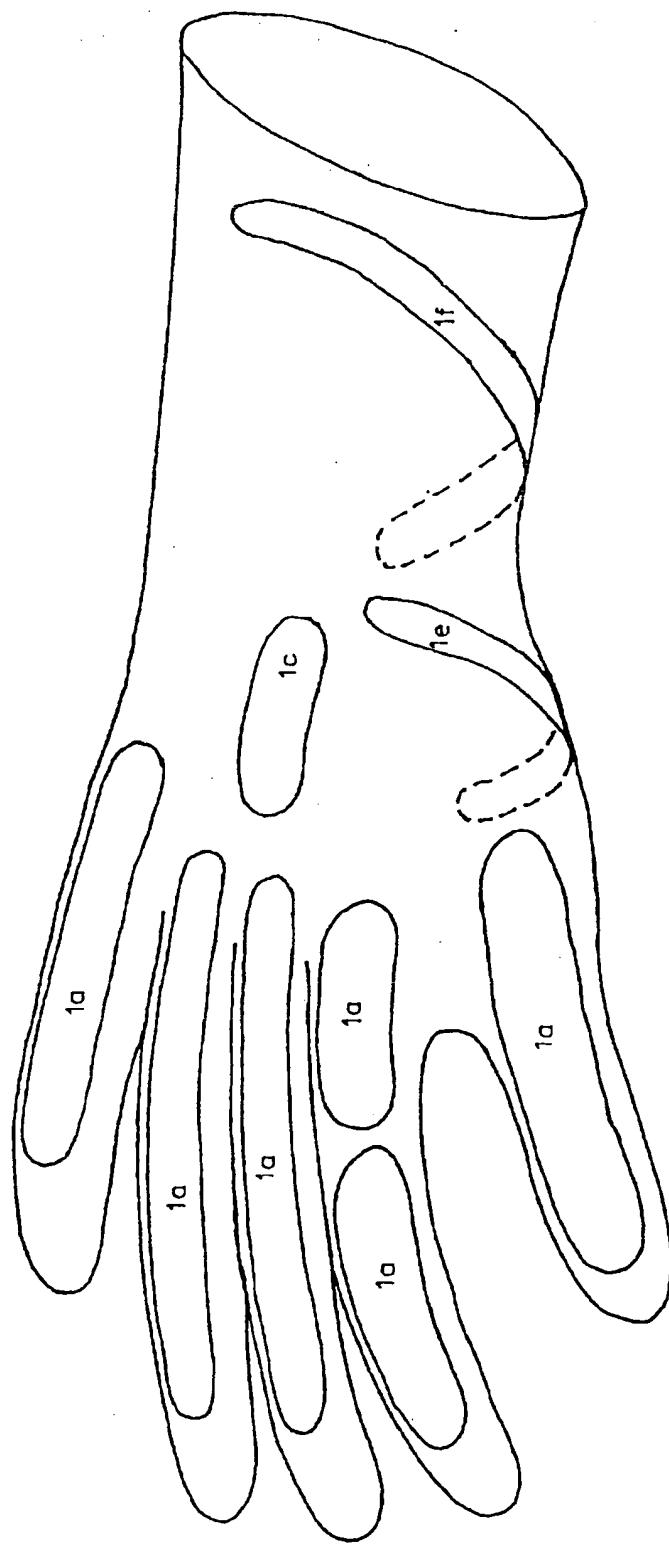


FIG. 1

2/4

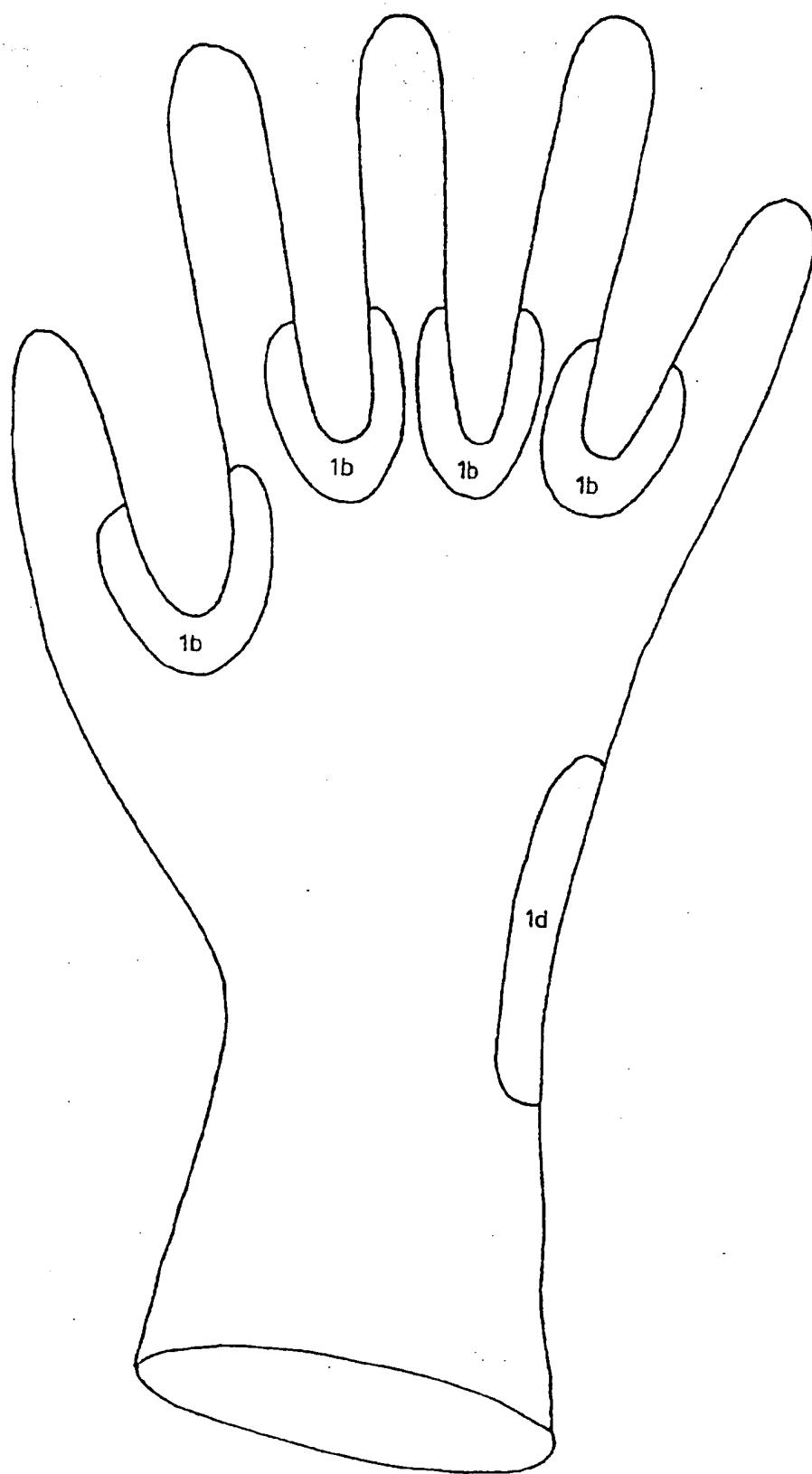


FIG . 2

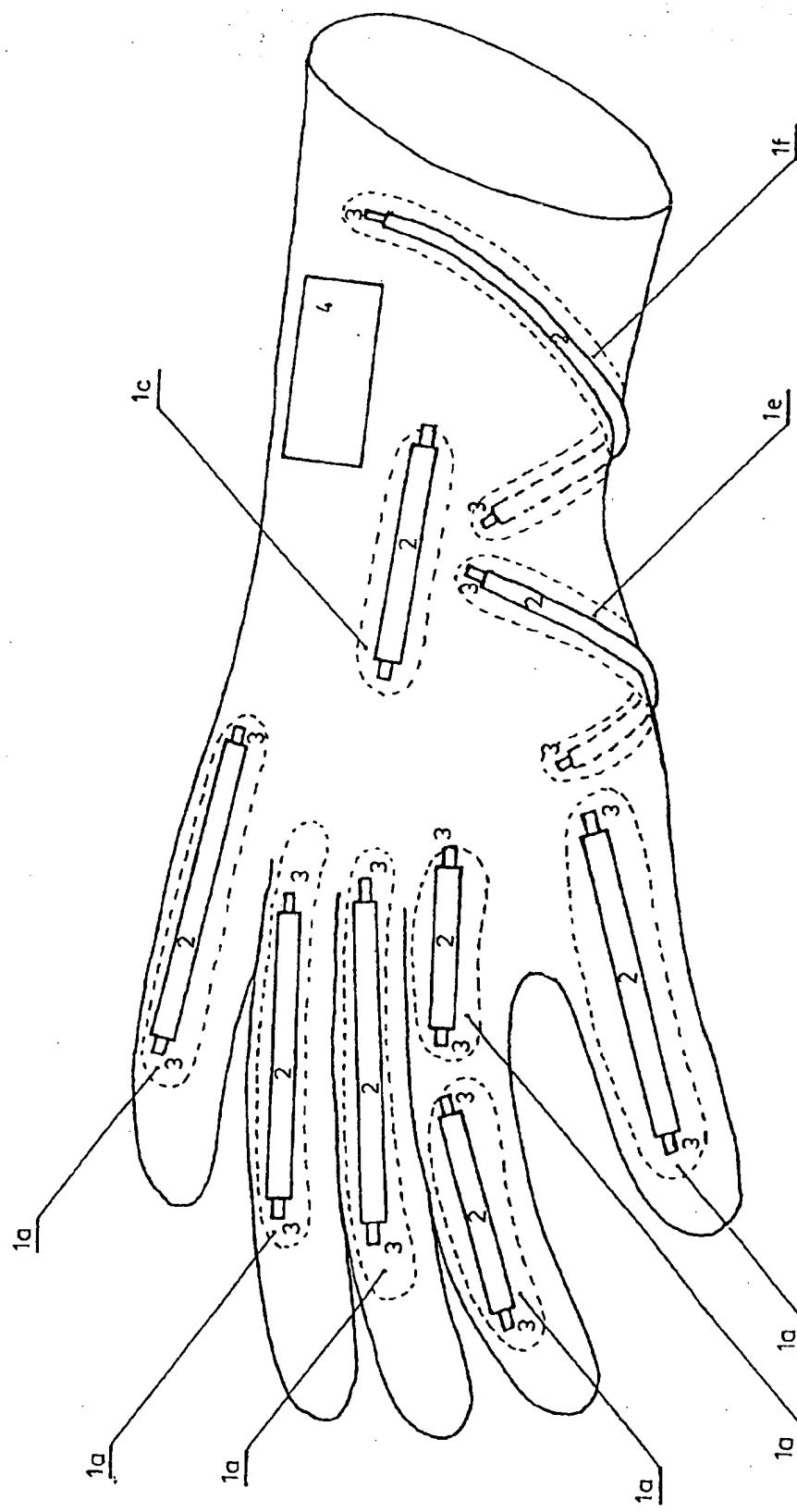


FIG. 3

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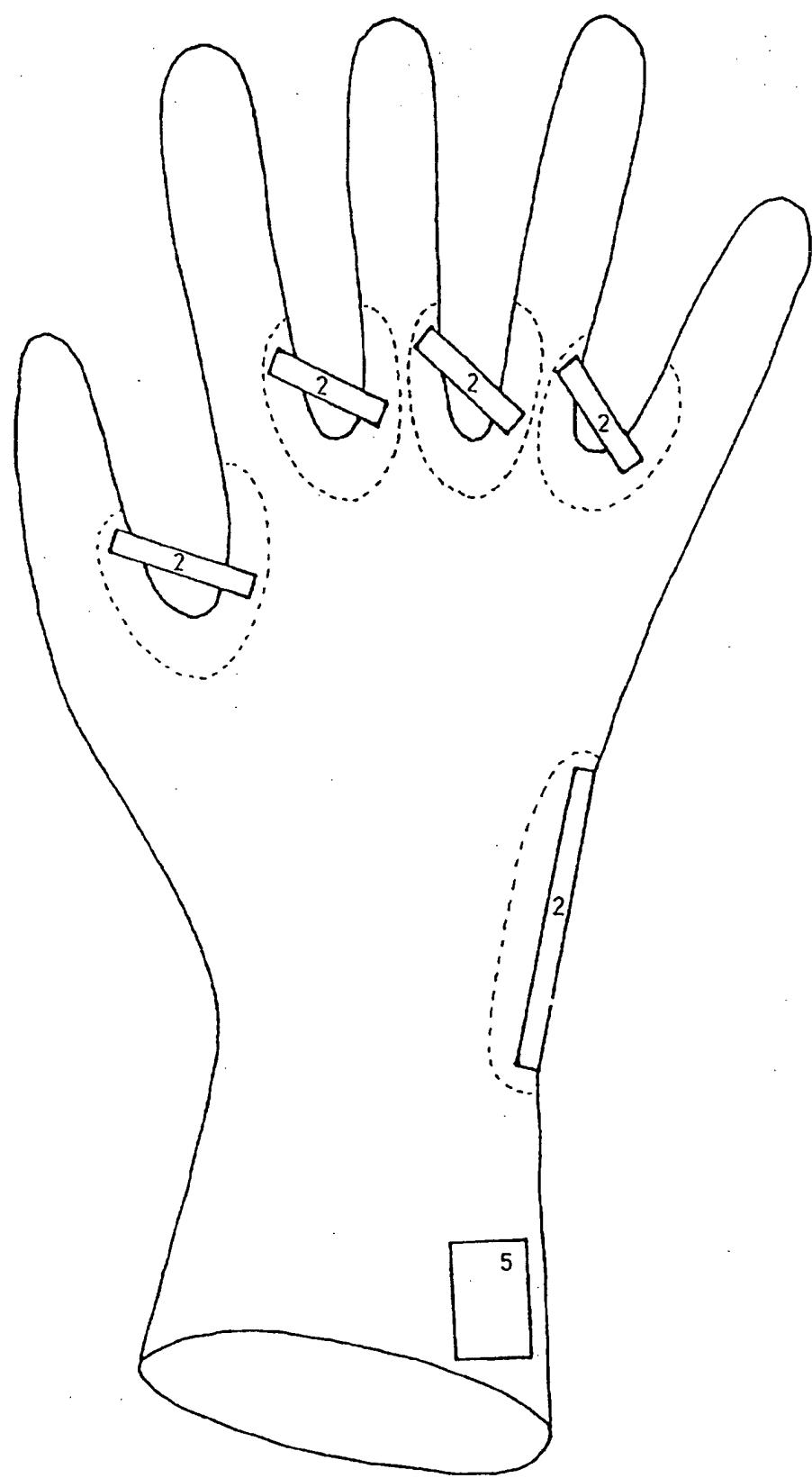


FIG . 4

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/SK 97/00007

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 A61B5/11 G06F3/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A61B G06F

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 414 537 A (G.J. GRIMES ) 8 November 1983 see column 3, line 25 - line 59 see column 5, line 11 - line 26 ---	1-6,8
X	US 5 086 785 A (C.T. GENTILE ET AL.) 11 February 1992	1-5
A	see column 3, line 1 - line 35 see column 4, line 68 - column 5, line 11 see column 6, line 1 - line 9 ---	8
X	EP 0 211 984 A (J.Z. LANIER) 4 March 1987	1
Y	see column 2, line 19 - line 37	2-6,8
A	see column 4, line 16 - column 6, line 15 see column 7, line 8 - line 48 ---	7
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1

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22 January 1998	28/01/1998
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